

# JOURNAL OF THE WASHINGTON ACADEMY OF SCIENCES

VOL. 44

October 1954

No. 10

BIOLOGY.—*Integration and individuation as elements of evolution.* A. A. WILLIAMSON, Washington, D. C. (Communicated by Waldo L. Schmitt.)

If we could first know where we are, and whither we are tending, we could better know what to do, and how to do it.—ABRAHAM LINCOLN

In a paper entitled *Speculation on the cosmic function of life* (Journ. Washington Acad. Sci. 43 (10). 1953), a schematic concept of biological evolution, therein called the pyramid of life concept, was outlined. Its essence is that biological evolution is factually progressive by objective criteria, empirically verifiable. Progress was shown as marked by the successive superimposition of one level (category) of life upon an earlier evolved one from which it so derives food or sustenance that a consequent diminution of comparative aggregate number, level by level, necessarily results, but no contraction of aggregate territorial dominion, which in every case is or becomes world wide in extent. Source of sustenance is thus made the primary criterion of evolutionary superiority. On this basis sustenance consumers are higher in nature's scheme of things than their sustenance suppliers, but the latter are given an irreversible priority of importance by their sustenance-supplier status. The over-all process registers progress because it works consistently toward a discernible End or Objective: the pyramid's adumbrated apex of numerical singularity in an eventual World Order of human national social organizations regionally or culturally associated as political units sustaining it. (It is axiomatic that progress per se is distinguished by movement toward some specific end or objective.)

The Pyramid of Life Concept has broad human interest and high philosophical import because it reveals meaning in the

evolution of life such as understandings of that process do not now have and the very possibility of which is often categorically denied. Despite any and all objections that may be raised against the concept, it may confidently be said that the pyramid itself is undeniably factual, while the concept's primary assumptions are so incontrovertible as to admit of no arguments contra. In its natural history and its scientific aspects it is so grandly comprehensive as to include both the esthetic and the theoretic components of things and our knowledge of them which Prof. Filmer S. C. Northrop has shown to be fundamental to philosophy, religion, and civilization. From its postulates can be drawn axioms, theorems, and propositions which are subject to detailed development. Moreover, by a speculative but not groundless extension, it can be given cosmic scope, which highlights the complete irrelevance of objections that living things are not closed systems. (They could not *process*—concentrate, refine, and relay—energy if they were.)

In addition, the concept seems to offer what may be the best philosophical justification for the democratic political system found since Berkeley and Hume exploded the Lockean philosophy so strongly reflected in our Declaration of Independence and our Constitution with its tripartite departmentalization of government. This justification is harmonious with the "gametic interpretation of history" proposed by Frederick Adams Woods when lecturer in biology in the Massachusetts Institute of Technology as an outcome of the application of his scientifically devised method of measuring historical causation, by him called historiometry, although it carries that inter-

pretation beyond the intentionally limited scope of his inquiry.<sup>1</sup>

In the JOURNAL paper above referred to it was possible only to sketch the concept in barest outline. No discussion could be introduced of two great trends, principles, or forces which—well known though they are—can not be known in their true significance unless their relation to the pyramid-building process is seen. To indicate that relation is the purpose of this paper.

These two principles or forces often appear to be mutually antagonistic but they are actually interacting and complementary. In this paper they will be called the Organic or Integrative Principle (Principle A) and the Individuative or Independence Principle (Principle B). Since they are already often referred to in the same or comparable terms, no difficulty should arise in understanding what they mean. By the operation of Principle A, evolved exemplars of Principle B are combined to form more complex biological units as well as higher levels of life.

While analogous principles operate in the inanimate world (e.g., chemical valence and such phenomena as the carbon and nitrogen cycles) to form the physical foundation of the pyramid of life and supply its material necessities, this discussion may conveniently start with life in unicellular form.

At the level of unicellular life, then, Principle A has already produced individuals which, in the great majority of cases, reflect the operation of Principle B by asserting and constantly endeavoring to maintain a self-sufficiency which resists all occasions and opportunities for joint, cooperative union with others of their kind if it requires subordination by restrictive specialization of function. Hence it is characteristic of the products of Principle A that upon attaining B status as individuals, competition is engaged in and any further unifying organization is rejected. To maintain their independent individuality is their main business in life. Nevertheless, there were exceptions to this rule. Through these exceptions, multicellular life began.

<sup>1</sup> Dr. Wood's work seems strangely unfamiliar to professionals in the social sciences and the humanities. See footnote 10.

Biological evolutionary progress appears always to involve particularity. It seems to have to wait upon the appearance of particular forms of life which lend themselves or are amenable to the operation of Principle A, the organizing principle. In his 1942 volume, *Evolution, the modern synthesis*, Julian Huxley says on page 558 that progress "may just as well prove to be partial as universal." But on the basis of the Pyramid of Life Concept it *has to be* partial. For every higher stratum of the pyramid depends for its existence upon the prior and continued existence of its immediately antecedent, evolutionarily inferior, and sustenance-supplying stratum. This *necessitates* a fixed evolutionary position for all such levels. Accordingly, not only unicellular life but also the vegetal, herbivorous, and carnivorous levels of life have been perpetuated "unto this day."

In a chapter on "Darwinism Today" in his book *Man in the modern world*, Huxley further states: "The single organism, looked at through evolutionary spectacles, has no meaning except in relation to a particular environment, to a particular set of enemies and competitors, to a particular past history, and to a particular set of potentialities for the future."<sup>2</sup> In this one sentence the word, particular, occurs no less than four times, but—for present purposes—it has greatest significance when it relates to "a particular set of potentialities for the future." In the sense of this paper that means when an organism is amenable to the operation of Principle A.

In a highly interesting article in the Atlantic Monthly for February 1946, under the caption "The Social Animal," the distinguished biologist Dr. Caryl P. Haskins, in collaboration with his wife, Edna F. Haskins, traces the evolutionary steps leading to the production of societies at different levels. He says: "On the basis of this single example [the alcoholic fermentation of sugar as performed by yeasts in the ripening of wines and spirits], which can be multiplied manifold, we may tentatively accept the view that, in certain aspects, the single cell too is a society, to which certain of the concepts of

<sup>2</sup> Mentor Books, no. M31, p. 176.

societies can be properly applied." Thus, even in the single cell, as already noted, Principle A has operated to produce exemplifications of Principle B; namely, individuals—with social connotations. In certain specific cases, these have been used for the further operation of Principle A.

In the same Atlantic Monthly article, Dr. Haskins shows how multicellular forms of animal life have most probably been evolved, "to culminate at last in the vertebrates. There specialization of the cellular components has become so finely developed, there the individuality of the colony has been so exaggerated at the expense of its once independent parts, that we no longer think of these colony-animals—these flamingos or these elephants or these men—as cellular communities at all." For the individuating principle (Principle B) has quite definitely claimed them for its own.

In the same article Dr. Haskins further states: "Every 'society' that we can name, at any level of life, shows in its evolution, and particularly in its inception, a well-marked trend to proceed from a simple to a more complex state." And he adds: "Purely on the basis of Darwinian natural selection, on the theory of 'the survival of the fittest,' it is not easy to understand why this unmistakable trend from the simple to the complex should be universal in the evolution of earthly societies. Over and over again we have vivid evidence that the advance from a solitary to a social existence cannot, in its early stages, have been wholly beneficial to the species in the sense that its survival value was increased relative to its competitors." He reinforces this by saying: "Every evidence seems to indicate that the first transition from the solitary to the colonial mode of life *was not an expedient move.*" (Italics supplied.) For no immediate competitive advantage could be seen to have accrued from that transition but, rather, the contrary. If, however, we can conceive of the whole evolutionary process as working through successive diminution of number toward a discernible End (the pyramid's eventual unitary apex), we can see in these evolutionary steps the complementary, interacting operation of Principles A and B, organizing, establishing,

organizing again and again establishing in methodical repetition. Only in this way is the major (i.e., the realm by realm) progress of evolution achieved. But in this way it is achieved, and achieved systematically.

In his outstanding work on this general subject,<sup>3</sup> Dr. Haskins develops his studies in detail, tracing "significant trends in the formation, the growth, and the duration of societies, notably those of men," as the jacket announcement summarizes it. He distinguishes between the closely integrated, caste-system type of social organization exemplified by insect (single family) societies and the loose, "associative" (herding) type common among vertebrates. Dr. Haskins holds societies to be organisms only by analogy, differentiating between biological man and cultural man: "The linchpin joining the biological social structure and man's cultural society in that intimate union called civilization is the human mind."<sup>4</sup> Historically, they are as inseparable as psyche and soma, for man's great evolutionary achievement was to create family-associative societies psychologically unified and organically articulated by group subservience to what were in essence (*as they still are*) concepts of nature plausible enough to win paramount human devotion. As Haskins puts it: "...it is frequently the associative structure and not the family which commands the highest loyalty of men."<sup>4</sup> (This is not yet wholly true in the Far East.)

It has been said that life and mind are correlates. The distinguished Indian physicist, Sir Jagadish Chandra Bose, showed in a series of experiments that, as far as we can discover, plant response to excitations of various kinds parallels if it does not accord fully with animal tissue response, the notable differences being such as could be attributed to structural differences. While differences in animal mentality are enormous, it is arguable that they are essentially a matter of degree. Neither absolute nor relative brain weight is a sure measure of intelligence in man or animal, but its use

<sup>3</sup> *Of societies and men*. Introduction by Vannevar Bush. W. W. Norton, New York, 1951.

<sup>4</sup> *Of societies and men*, pp. 208 and 178, respectively.

to create cultures and civilizations makes man unique.

Insect life is, indeed, governed almost wholly by what we call instinct, but there is abundant evidence that many warm-blooded animals display intelligence in their reactions to the exigencies of their mode of life. And predatory carnivores as a class constantly show a mentality superior to that of their herbivorous prey. The predatory habit makes that mandatory.

When, in the pyramid-constructing process, the carnivorous animal level had been established, then the sustenance-supplying potentialities of the mineral kingdom, of vegetation, and of animal matter had been thoroughly exploited by a great variety of life forms. Consequently, there then remained no way to raise the pyramid to higher levels by the same source-of-sustenance criterion except to exploit the sustenance-supplying potentialities of mentality. This was done through the evolvement of societies.

Now, mere size is in many ways a biological factor, as Huxley, Schrödinger,<sup>5</sup> Haskins, and others have noted. And so, although insects were the first to evolve true societies showing in many ways a remarkable use of mentality, they simply could not fulfill nature's evolutionary requirements for pyramid-constructing purposes, for they could not wrest evolutionary supremacy from the carnivores. Only man has met those requirements, and by his superlative power to exploit the only remaining source of sustenance—mentality. It is, indeed, *as if* evolution had been preparing for this eventuality from the very beginning as it built up the vegetal and the herbivorous and carnivorous animal levels of the pyramid's physical organismal realm of life. Evolutionarily speaking, this is the *raison d'être* of human social organisms, whose source of sustenance is mentality, increasingly developed through the complementary operation of Principles A and B. Man—and man alone—has made mentality supreme.

So powerful, so inherently fixed, is the

<sup>5</sup> *What is life?* Cambridge University Press, 1944. Reprinted 1945, 1948, 1951, with a note to chapter 6.

gregarious impulse in man that he seems never to have existed as a solitary animal. Always he is found to be a social animal. And social living, with its manifold contacts and associations, inevitably requires commonly accepted norms of conduct and ways of thought. In their complex interrelations, these constitute what we call culture. No established human group has ever been known that did not have its culture, always institutionally embodied. Such institutions are analogs of the specialized parts of physical organisms. They make cultures organic: as their organs, they rule the life of man. Yet mind-generated movements can change them if philosophically required. For, as Frederick Watkins has said: "In the long run . . . no movement can evoke the fullest energies of its supporters unless it offers them an adequate justification for the things they are doing."<sup>6</sup> And no such justification is adequate unless it reflects the scientific knowledge of the time, which itself changes with time.

Sociologically speaking, culture and civilization do not differ essentially, civilization merely being culture in a more or less advanced (complex) stage of development. Nevertheless it can be said that here, too, size is a factor. Systematic agriculture has been and still is the invariable basis of civilization. Historically, it fixed cultures in permanent locations, provided an abundant and dependable food supply, promoted population increase, and encouraged if it did not require the building of cities, which have become the hallmark of civilization. Yet it is highly improbable that advances toward civilization could have been made as they have been made if man had been unable to communicate ideas through the media of language and symbols, and to develop what has become, perhaps, the greatest civilizer of all: the invention and use of tools.

As Haskins has emphasized, what he calls "margins of vitality"<sup>7</sup> play an indispensable part in the advance of culture as civilization. Representing as they do the accumulation and exploitation of conserv-

<sup>6</sup> *The political tradition of the West*, p. 358. Harvard University Press, 1948.

<sup>7</sup> *Op. cit.*, p. 231 et seq.

able, need-supplying surpluses, both material and ideational in character, their number and complexity very largely determine the height of civilization attainable by any specific culture. Since, however, the elements of culture in its various stages are often transmissible, a civilization may become widely established geographically under favorable conditions.

As defined by the Dictionary of Sociology,<sup>8</sup> "The true nation is probably the most stable and coherent large-scale human group yet produced by social evolution," and a nation is "A nationality that has achieved the final stage of unification represented by its own political structure and territorial establishment." Further: "A true nationality is animated by consciousness of kind and has a fundamental similarity in its mores." Parenthetically, a nationality is never a nation unless it dominates territory, as all living things must do.

The operation of Principles A and B is plainly observable in human history. All the earlier civilizations, of both the Old World and the New, exhibited national organization of the closely integrated, caste-system type, analogous to that of the social insects. In these early stages, social status and opportunity to exercise intelligence were determined almost entirely by birth.<sup>9</sup> And, as Frederick Adams Woods has shown historiometrically, the political and economic prosperity of absolute European monarchies, including Turkey, almost invariably depended directly on and quickly reflected the character and abilities of the reigning sovereign. These—good, bad, or indifferent—he found to be gametically determined. Of the two biological factors, inheritance and environment, the first was shown to be far more powerful. Nevertheless, from time to time, superior intellects from without the pale occasionally appeared and seized the prize of power or founded a line of heredity which was able to do it.<sup>10</sup>

<sup>8</sup> Philosophical Library, Inc., New York, 1944.

<sup>9</sup> Under such a system Sir Isaac Newton, as the son of a small farmer, would himself have been compelled to be a small farmer without hope of ever being anything else.

<sup>10</sup> *Mental and moral heredity in royalty*. Henry Holt, New York, 1906. *The influence of monarchs*. Macmillan, New York, 1913.

It was, of course, in ancient Greece that the idea of freedom and liberty first arose and found expression in the democratic political system. This led directly to a great outburst of intellectual activity and accomplishment such as had never before been seen and to which we are deeply indebted even today. But modern democracy derives more from the assemblies of the Teutonic peoples, especially the Witenagemot of the Anglo-Saxons, than from Greece and Rome.

It is the peculiar glory of the democratic political system that it removes restrictions which so long had held to a minimum the operation in human history of that third biological factor, genetic recombination and mutation. By that removal the doors of opportunity are opened to all without discrimination. It thus makes socially available all those superior mentalities of varying degree which can and do arise in any and all levels of society by whatever criterion and to which the world owes much. Without it civilization in its more advanced stages (i.e., mechanized industry) cannot flourish. This third biological factor can be assured full and free play only by the democratic system. To quote again from Frederick Watkins: "If the maximization of human potentialities is the ultimate secular value, and if the realization of that value depends on the maintenance through legislation of optimum social conditions, it follows that political action is an indispensable part of the moral responsibility of men."<sup>11</sup> It is to be noted that "the ultimate secular value" specified is only negatively hedonistic—"a calculus of pleasure and pain." Positively, it aims at the utmost possible state of societal homeostasis.

From the viewpoint of this paper, what the democratic political system does is to make nations successfully adopting it more truly and thoroughly psychozoic organisms because it permits them to draw mental and spiritual sustenance from *all* their human sustainers instead of from a restricted segment of them only. Ideally, every citizen has full opportunity—and is, indeed, expected—to make his contribution by the

<sup>11</sup> Op. cit. supra, p. 251.

discovery (including the self-discovery) and the development of his mental endowments. It is the unpredictability of individual human potentialities which gives such value to the democratic high regard for the sanctity of the individual person, his rights and liberties. But these carry with them political and social duties and responsibilities which are, alas, less often stressed.

It is now recognized in philosophical circles if not elsewhere that what the democratic political system actually does is to hold in operational balance at the human national societal level those two great evolutionary trends, forces, or principles here called the Organic or Integrative Principle (Principle A) and the Individuative or Independence Principle (Principle B).<sup>12</sup> That level constitutes the first true level of the psychozoic organismal realm of the grand, mammalian pyramid of life, that realm of life in which evolutionary progress at last makes mind, mentality, or intellect supreme.

The freeing of the mind as only democracy can free it, to range wherever it will, is the best guarantee humanity can have that mass intelligence will sooner or later come to reign over mass emotion and hold it in control throughout the world. It is therefore the best guarantor of eventual world peace.

In a broad, general way, then, it can truthfully be said that the two interacting, complementary principles herein discussed operate in the over-all biological evolutionary process and are essential to it. Only when that is perceived do we realize that they have made and still make possible the successive superimposition of level on level in the pyramid of life to which man and his cultures and civilizations belong. For they can be seen to be operative in human history precisely as they have operated in earlier times on subhuman forms of life.

One of these principles (Principle A) has operated to bring animate nature (life) out of the insensate world of matter; to transmute unicellular forms into multi-

cellular organisms; and to produce insect and human societies. Cooperation is its "keynote."

The other principle (Principle B) has operated to establish and perpetuate the various successive levels of the pyramid as they emerged and proved their power to exist. Its "keynote" is competition involving Darwinian natural selection.

Without the complementary operation of these two principles the construction of our pyramid of life—or any other—would not have been possible. It is because they have operated that our pyramid is as it now stands, visible around us wherever we may be.

Today, in current history, the creative operation of Principle A seems clearly evident. Despite all anathemas against it, the spirit of nationalism is spreading in the Far East, where cultural tradition neither induces nor fosters it yet where even democracy is being attempted. In the West, the competition of antagonistic doctrines is compelling the democratic nations to organize, as in the North Atlantic Treaty Organization, here held to be symptomatic of what will slowly develop everywhere to form a pyramidal level of regional supranational organizations if not organisms, all in antecedence to a still higher level to constitute in actuality what is now but the logically adumbrated apex of the pyramid as a unitary World Order.

Thus does the Pyramid of Life Concept, schematically reflecting biological evolutionary principles, illuminate human history prophetically by its revelation of meaning therein—a meaning, moreover, which is "publicly valid" in the sense of holding good at all times for all men everywhere. Nor are future refinements in evolutionary theory likely ever to diminish that validity, for it is rendered independent of detail by the breadth of its outline, the grandeur of its scope.

They are one with evolution itself.

Grateful acknowledgment for permission to quote at some length from their designated publications is made to the following: The Atlantic Monthly, W. W. Norton & Co., Inc., Harvard University Press, and Philosophical Library, Inc.

<sup>12</sup> Northrop, F. S. C.: *The meeting of East and West*. Macmillan, New York, 8th printing, p. 191, 1951. Also Haskins, op. cit. supra, p. 260f.